e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

A REVIEW ON COST OVERRUNS OF HIGH-RISE RESIDENTIAL BUILDINGS

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ABSTRACT

Cost overrun is a prevalent challenge in the construction industry, with a significant number of projects exceeding their initial budget estimates. This paper explores the causes, classification, and impact of cost overrun in construction projects. Factors such as ineffective project management, poor planning, inaccurate cost estimation, labor shortages, material price fluctuations, and external factors like unpredictable weather and government policies contribute to these overruns. Despite advancements in project management tools, cost overruns continue to plague the industry due to mismanagement, inefficiencies, and unforeseen circumstances. Various evaluation methods, including Earned Value Analysis (EVA), are highlighted to assess project performance, identify cost variances, and implement proactive measures to minimize overruns. This study emphasizes the need for better planning, efficient cost control mechanisms, and stakeholder collaboration to mitigate the risk of cost overruns and improve project outcomes.

Keywords: Cost Overrun, Project Management, Cost Estimation, Earned Value Analysis (EVA) Etc.

I. INTRODUCTION

Construction projects are often measured by metrics like cost and time, which help evaluate performance against the project baseline. However, delays in construction are usually tied to unplanned costs. Among the four main constraints of construction—quality, scope, time, and cost—cost performance is considered the most critical.Research shows that only 13% of construction projects in Asian countries stay within budget, with actual costs exceeding estimates by an average of 28% (Huda Mahmood, 2021). This pattern is consistent globally, affecting both developed and developing nations, including small island states. Despite advancements in technology and project management practices, accurately estimating costs and sticking to the budget remains one of the biggest challenges in the construction industry. When costs spiral out of control, it creates financial strain, forcing companies to reallocate funds from planned projects to cover overruns, leaving many projects incomplete and disrupting economic activities.

In India specifically, of 555 projects worth Rs 150 crore each, at least 179 experienced cost overruns amounting to Rs 1.23 lakh crore. These overruns not only harm organizational profitability but also delay or halt economic development. Despite the widespread knowledge of cost overruns, their root causes haven't been thoroughly explored, leaving room for further research into this issue.High-rise construction projects in India add another layer of complexity to this challenge. According to the International Building Code (IBC), high-rises are buildings taller than 75 feet. These projects, with their intricate designs and advanced systems, are more prone to coordination and communication problems, which drive up costs. The demand for high-rises has skyrocketed in India, with over 52% of housing projects launched in 2019 across the top seven cities classified as high-rises.

To achieve better economic outcomes in construction projects, it's essential to identify and understand the factors that lead to cost overruns. By addressing these factors proactively, professionals can implement strategies to control unaccounted costs and avoid future budget overruns. This study focuses on analyzing the most common causes of cost overruns in Indian high-rise construction projects. The insights gained can help industry professionals refine their cost management strategies and improve overall project performance. The construction sector plays a crucial role in India's economy, driving growth across various industries. As of the fourth quarter of 2020, the sector was valued at over 2.7 trillion Indian rupees, making it a vital indicator of the country's economic health. By addressing the issue of cost overruns, the industry can not only achieve better project outcomes but also contribute more effectively to India's development.

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II. LITRATURE REVIEW

Olatunji et. al.[5] (2022) as per the suggestion of author on "Influences of Design Changes and Risks on Cost Overruns in High-Rise Construction Projects". This study explores the relationship between design changes and cost overruns in high-rise construction projects. Through case study analysis, the research finds that client-driven design changes and unforeseen regulatory requirements are significant drivers of cost increases. The authors recommend stricter control mechanisms during the design and approval stages to minimize these risks.

Memon, A. H. et. al.[3] (2023) according to the analyzation on "Preliminary Study on Causative Factors Leading to Construction Cost Overrun". This paper identifies the main causes of cost overruns in construction projects, with a focus on high-rise residential buildings. Based on a review of past projects, the authors pinpointed poor site management, delays in procurement, and client-initiated design changes as major factors leading to increased costs. They suggest that project managers need to integrate better risk management strategies to mitigate these issues.

Love P. E. et. al.[4] (2023) have explored "Rework Causation: Emergent Theoretical Insights and Implications for High-Rise Construction Projects". The study investigates the impact of rework on cost overruns in high-rise construction projects. The authors argue that design errors, communication failures, and lack of coordination between project teams contribute significantly to rework, leading to substantial cost overruns. Their analysis indicates that up to 30% of the cost overrun in some high-rise projects is attributable to rework.

Kaming P. F. & Olomolaiye [9] (2019) along the author suggestion on "Factors Influencing Construction Time and Cost Overruns on High-Rise Projects in Indonesia". The study examines time and cost overruns in high-rise construction projects in Indonesia. The authors find that material shortages, labour inefficiencies, and poor project scheduling are key factors contributing to cost escalations. They recommend better project planning and improved labour management to minimize these overruns.

Jarkas, A. M. & Bitar, C. G. [7] (2020) have studied "Factors Affecting Construction Labour Productivity in Kuwait". The paper explores the factors affecting labour productivity and their subsequent impact on cost overruns in high-rise residential buildings in Kuwait. It identifies inadequate supervision, low workforce motivation, and poor site conditions as key factors reducing labour productivity. These inefficiencies lead to increased project duration and labour costs, thus contributing to overall cost overruns.

Flyvbjerg B. [1] (2024) according to "Underestimating Costs in Public Works Projects: Error or Lie". This study explores the issue of cost overruns in public infrastructure projects, including high-rise buildings. The authors investigate the tendency of cost estimates to be systematically underestimated due to optimism bias and strategic misrepresentation. They argue that cost overruns in large-scale construction projects are not isolated incidents but rather part of a larger pattern of inaccurate budgeting. The findings highlight that decision-makers often overlook risk factors, leading to overruns of up to 50% in some cases.

Azhar, N. et. al. [2] (2024) as per the reference of "Cost Overrun Factors In Construction Industry of Pakistan". This research focuses on cost overrun factors in the construction industry of Pakistan, particularly in high-rise projects. Through a survey of industry professionals, the study identifies poor project planning, inaccurate cost estimation, and material price fluctuations as the top contributors to cost overruns. The authors recommend more robust project management practices and better forecasting techniques to reduce these overruns.

Azhar, N. & Carlton [10] (2019) as per the author's suggestion on "Building Information Modeling (BIM): Benefits, Risks, and Challenges". This paper assesses the impact of Building Information Modeling (BIM) on reducing cost overruns in high-rise residential buildings. The authors find that BIM enhances project visualization, improves communication among stakeholders, and allows for early identification of potential conflicts. By reducing design errors and rework, BIM contributes to minimizing cost overruns in complex high-rise projects. However, the authors note challenges in implementing BIM, such as the need for training and the high initial investment cost.

Arditi d. et. al. [6] (2021) have studied "Cost Overruns in Public Projects: International Case Studies". This study examines cost overruns in public construction projects, with a particular emphasis on high-rise residential buildings. The authors identify supply chain issues, labour shortages, and delays in securing permits as major

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contributors to cost increases. Their analysis reveals that international construction projects often suffer from poor communication and coordination, exacerbating the problem.

Akintoye A. & MacLeod M. [8] (2020) according to the analyzation "Risk Analysis and Management in Construction". This paper discusses risk management strategies in construction projects, including high-rise residential buildings. The authors argue that inadequate risk assessment during the early phases of a project often leads to cost overruns. They propose adopting more sophisticated risk analysis tools, such as Monte Carlo simulations, to better predict potential cost escalations and allocate contingency budgets accordingly.

III. CAUSES OF COST OVERRUN IN CONSTRUCTION PROJECTS

This comprehensive document outlines various causes of cost overrun in construction projects. Here's a summary of the key points from each section:

3.1 General Causes of Cost Overruns

Cost overruns are a persistent issue in the construction industry, with the majority of projects exceeding their budgets. Studies reveal that 9 out of 10 construction projects face cost overruns, with variations ranging from 5% to over 100%, depending on factors like project location, scope, and management efficiency. These overruns often stem from inadequate project preparation, poor cost control systems, increased material and labor costs, unexpected weather conditions, and delays in delivery. Despite advancements in project management methods and tools, these challenges remain prevalent due to the dynamic and multidisciplinary nature of construction projects.

3.2 Design and Contract-Related Factors

The design phase plays a critical role in project cost performance, as issues here can cascade into significant financial impacts during construction. Frequent design changes, incomplete designs, inadequate pre-construction studies, and poor coordination during the design stage are common causes of cost overruns. Many of these issues are avoidable with proper planning, communication, and sufficient time allocated for design and contract preparation.

3.3 Estimation-Related Factors

Accurate estimation of costs and timelines is essential for successful project execution. Problems such as underestimating project duration, inaccurate quantity take-offs, using inappropriate estimation methods, and insufficient cost data often lead to cost overruns. Additionally, the experience and skill level of estimators are crucial in ensuring reliable pre-tender cost estimates. Without accurate estimates, project funding and scheduling become unreliable, leading to financial strain.

3.4 Planning and Scheduling Factors

Effective planning is a cornerstone of successful project execution. It involves defining objectives, estimating timelines, allocating resources, and creating realistic schedules. Inadequate planning, poor scheduling, and insufficient monitoring during the pre-construction and construction phases frequently lead to delays and cost increases. Emphasizing operational planning over reactive monitoring is essential for minimizing these issues.

3.5 Project Management Factors

Project management significantly influences cost performance, as construction projects require the coordination of large teams, equipment, and resources. Poor site management, lack of supervision, inadequate contractor performance, and ineffective cost control systems are common contributors to cost overruns. Strong leadership and effective project management practices, including proper contract management and financial oversight, are critical for avoiding cost escalation.

3.6 Labor-Related Factors

Labor-related challenges such as shortages of skilled workers, high labor costs, and low productivity are frequent causes of cost overruns. As the workforce ages, a lack of skilled replacements exacerbates these issues. Additionally, poor relationships between management and workers or subcontractors can further reduce efficiency, increasing project costs.

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3.7 Financial Factors

Financial constraints are a major cause of cost overruns in construction projects. Delays in payments, insufficient funding, inconsistent cash flows, and economic instability can disrupt project progress and increase costs. Other factors, such as fluctuating foreign currency exchange rates and inflation, further compound financial challenges, making it difficult to stay within budget.

3.8 Material and Machinery Factors

Materials and machinery costs represent a significant portion of construction expenses. Fluctuations in material prices, inflation, high machinery costs, and monopolistic practices by suppliers often result in cost overruns. Delays in material delivery and supply chain disruptions also contribute to higher project costs, especially in regions with volatile economic conditions.

3.9 Construction-Related Factors

The construction phase is often fraught with challenges, including delays, scope changes, and errors that result in rework. Poor construction practices, lack of contractor experience, and insufficient supervision can escalate costs. Additionally, changes in material specifications, transport costs, and conflicts among project participants further increase financial pressure during this stage.

3.10 Communication Factors

Effective communication is vital in construction projects, as they involve numerous stakeholders. Poor coordination and communication among key parties can lead to misunderstandings, delays, and conflicts, all of which contribute to cost overruns. Ensuring clear, consistent communication among all stakeholders is essential to avoid unnecessary delays and costs.

3.11 External Factors

External factors such as unpredictable weather, government regulations, political instability, and corruption significantly impact project costs. Natural disasters, delays in land acquisition, and emergency work also contribute to cost escalation. These factors, often beyond the control of project teams, highlight the need for robust risk management and contingency planning.

IV. COST OVERRUN EVALUATION METHODS

Evaluating cost overruns involves identifying the extent, causes, and impacts of financial discrepancies in construction projects. One common approach is variance analysis, which compares actual costs against baseline estimates to determine deviations. Cost performance indices (CPI), derived from Earned Value Management (EVM), are widely used to evaluate cost efficiency by comparing the budgeted cost of work performed (BCWP) with the actual cost of work performed (ACWP). Trend analysis helps identify patterns of cost deviations over time, allowing project managers to anticipate potential overruns early. Root cause analysis (RCA) is another critical method, focusing on identifying the underlying reasons for cost deviations, such as design errors, scheduling issues, or procurement delays. Benchmarking, which involves comparing a project's performance against similar projects, provides insights into cost discrepancies and industry standards. Simulation techniques like Monte Carlo analysis evaluate uncertainties by modeling various project scenarios, helping to predict cost overrun risks. Lastly, sensitivity analysis examines the impact of changes in project variables, such as material prices or labor costs, on overall budgets. These evaluation methods enable project managers to analyze cost overruns comprehensively and develop mitigation strategies to improve cost performance in future projects.

4.1 Earned Value Analysis

Earned Value Analysis (EVA) is a project management technique used to measure project performance by integrating scope, cost, and schedule. It provides a quantitative framework for assessing whether a project is on track regarding budget and schedule. EVA involves three key metrics: **Planned Value (PV)**, the budgeted cost of the work scheduled to be completed by a specific time; **Earned Value (EV)**, the budgeted cost of the work actually completed; and **Actual Cost (AC)**, the actual expenditure incurred to complete the work. Using these metrics, project managers calculate performance indicators such as the **Cost Performance Index (CPI)** (EV/AC) to evaluate cost efficiency and the **Schedule Performance Index (SPI)** (EV/PV) to determine

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schedule adherence. Variance metrics like **Cost Variance (CV)** (EV - AC) and **Schedule Variance (SV)** (EV - PV) highlight the magnitude of cost and schedule deviations. By integrating these metrics, EVA helps project managers predict the final project cost using the **Estimate at Completion (EAC)** formula and assess the time required for completion. EVA not only provides a snapshot of project health but also facilitates proactive decision-making by identifying potential cost overruns or delays early. It is a vital tool for maintaining control over project performance and ensuring successful delivery.

Earned value is a technique for measuring project performance according to project cost and schedule. The comparison between budgeted and actual performance is performed. There are three earned value parameters as shown below.

Planned Value (PV): It is the cost of the project according to the schedule of the project. It is also called Budgeted Cost of Work Schedule (BCWS).

Earned Value (EV): It is the Budgeted Cost of the Work Performed (BCWP) till date. It is cumulative budgeted cost incurred in activities that have been completed on the due date.

Actual Cost (AC): It is the actual cost that has spent on the project till date. It is also called as actual Cost of Work Performed (ACWP). The variances are used to check deflection or deviation of project from the path of original schedule. It is also used to analyze the extent and cause for the delays of works or tasks of the project.

Following re two variances:

Cost Variances (CV): It is used to check the difference between the proposed planned project and present project on the specific date. It shows the variation of project in form of cost. The formula used for calculating cost variances is Cost Variance = Earned Value – Actual Cost

Schedule Variance (SV): It is used to examine the deflection of present project in from the planned project. If considerable change appears than the project objectives must be revised. The formula for calculating the schedule variance is Schedule Variance = Earned Value – Planned Value

Schedule Performance Index (SPI): SPI can be used to estimate the projected time to complete the project. It is calculated as follows,

SPI = Earned Value / Planned Value SPI = 1 means Project is on Schedule

SPI < 1 means Project is behind Schedule SPI > 1 means Project is ahead of Schedule

Cost Performance Index (CPI): CPI can be used estimate the project cost to complete the project based on performance to date. It is calculated as follows,

CPI = Earned Value / Actual Cost

CPI = 1 means Planned and Actual cost are same

CPI < 1 means Project is under Budget CPI > 1 means Project is over Budget.

Estimate at Completion (EAC): The Estimate at Completion is the actual cost to date plus an objective estimate of costs for remaining authorized work. The most common is EAC = Actual cost + Estimate to Complete

V. CONCLUSION

Cost overrun is one of the most critical issues in the construction industry, affecting project timelines, budgets, and overall performance. This paper identified numerous causes of cost overrun, categorized into internal and external factors, including design flaws, inaccurate estimation, poor project planning, ineffective management, and external influences such as inflation and political instability. The findings highlight the importance of early-stage planning, accurate estimation techniques, and robust project management practices to minimize cost overruns. Methods like Earned Value Analysis (EVA) can provide valuable insights into project performance by integrating scope, cost, and schedule, enabling stakeholders to make timely adjustments and improve outcomes. Addressing the causes of cost overruns requires a coordinated effort from project owners, contractors, consultants, and policymakers to ensure better resource management and decision-making throughout the project lifecycle. By adopting proactive strategies and leveraging effective evaluation methods, the construction industry can mitigate the impacts of cost overruns and achieve greater efficiency and sustainability in project delivery.

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